

What is claimed is:

1. A light regulating device comprising:

a photonic crystal including a material that is capable of varying its refractive index in accordance with an electric field, the photonic crystal having a photonic bandgap in a specific frequency range; and

an upper transparent electrode and a lower transparent electrode arranged on an upper side and a lower side of the photonic crystal, respectively, to which a voltage is applied,

wherein a size of the photonic bandgap of the photonic crystal is controlled by the voltage applied between the upper transparent electrode and the lower transparent electrode.

2. The light regulating device as claimed in claim 1, wherein a reflection amount of visible light reflected in a specific frequency range from the photonic crystal is variable based on an electric field applied to the photonic crystal.

3. The light regulating device as claimed in claim 1, wherein a penetration amount of visible light penetrated in a specific frequency range from the photonic crystal is variable based on an electric field applied to the photonic crystal.

4. The light regulating device as claimed in claim 1, further comprising:

an upper transparent substrate and a lower transparent substrate having the upper and lower transparent electrodes, respectively, coated thereon, the upper transparent substrate and the lower transparent substrate being capable of applying an electric field to the photonic crystal, wherein the upper transparent substrate and the lower transparent substrate are attached on the upper side and the lower side of the photonic crystal, respectively.

5. A photonic crystal display device utilizing bandgap controls, comprising:

a plurality of photonic crystals including a material that is capable of varying its refractive index in accordance with an electric field, each of the plurality of photonic crystals having a photonic bandgap in a different frequency range; and

a plurality of transparent electrodes formed on opposing sides of each of the plurality of photonic crystals for independently applying a respective predetermined electric field to each of the plurality of photonic crystals,

wherein a size of a photonic bandgap of each of the plurality of photonic crystals is controlled by the electric voltage respectively applied to the corresponding one of the plurality of transparent electrodes.

6. The photonic crystal display device as claimed in claim 5, wherein the plurality of photonic crystals are arranged on a two-dimensional plane.

7. The photonic crystal display device as claimed in claim 5, wherein the plurality of photonic crystals are vertically arranged.

8. The photonic crystal display device as claimed in claim 5, wherein a reflection amount of visible light respectively reflected in a specific frequency range from each of the plurality of photonic crystals is variable based on the electric field applied to that one of the plurality of photonic crystals.

9. The photonic crystal display device as claimed in claim 5, wherein a penetration amount of visible light respectively penetrated in a specific frequency range from each of the plurality of photonic crystals is variable based on the electric field applied to each one of the plurality of photonic crystals.

10. The photonic crystal display device as claimed in claim 5,
further comprising:

a plurality of transparent substrates on which a pattern of the transparent electrodes capable of independently applying the predetermined electric field to each of the plurality of photonic crystals is coated are attached on sides of each of the plurality of photonic crystals.

11. The photonic crystal display device as claimed in claim 5,
further comprising:

a plurality of insulation spacers formed between each of the plurality of photonic crystals to electrically and spatially separate each of the plurality of photonic crystals.